ENTRY NO. 10

NAME OF MACHINE TRIUMF Cyclotron
INSTITUTION TRIUMF (Universities of Alberta, B.C. Victoria and Simon Fraser University)
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IN CHARGE E. W. Vogt REPORTED BY H.R. Schneider and M. Zach

HISTORY AND STATUS

DESIGN, date July 1966 Model tests December 1966
ENG DESIGN, date October 1968
CONSTRUCTION, date January 1970
FIRST BEAM, date (or goal) December 1974
MAJOR ALTERATIONS
COST, ACCELERATOR CAN $12,000,000. (1974)
COST, FACILITY, total CAN $50,000,000. (1984) **
FUNDED BY AECB, NRC, and TRIUMF Universities

ACCELERATOR STAFF, OPERATION AND DEVELOPMENT

SCIENTISTS 15 ENGINEERS 19
TECHNICIANS 55 CRAFTS 22
GRAD STUDENTS involved during year 2
OPERATED BY Research staff or 19 Operators
OPERATION 24 x 7 hr/wk. On target 24 x 6 hr/wk
TIME DISTR. in house 60 %, outside 40 %
BUDGET, op & dev CAN $26,000,000.
FUNDED BY National Research Council of Canada

RESEARCH STAFF, not included above

USERS, in house 122 * outside 168
GRAD STUDENTS involved during year 32
RESEARCH BUDGET, in house CAN $4,600,000.
FUNDED BY NSERC

MAGNET

POLE FACE, diameter (compact) 1717 cm, R-extraction 780 cm
R injection 25 cm
GAP, min 52.8 cm, Field 5.8 kG
max cm, Field 2.0 kG } at 0.72 x 10^6 Ampere turns
AVERAGE FIELD at R ext 4.6 kG
B max/<B> 1.26
NUMBER OF SECTORS { compact / separated 6 } Spiral, max 70 deg
SECTOR ANGLE (SSC) deg
TRIMMING COILS 55 circular
13 harmonic
CONDUCTOR, material and type Al
STORED ENERGY (cryogenic) MJ
POWER: main coils 1270 max kW: current stability 7 x 10^{-7}
trimming coils 68 max kW: current stability 0.1% F.S.
WEIGHT: Fe 4000 tons: coils 170 tons
COOLING system closed loop water
ION ENERGY (Bending limit) E/A = 520 q^2/A^2 MeV/amu
(Focusing limit) E/A = q/A MeV/amu

ACCELERATION SYSTEM

DEES, number 2 angle 180 deg
BEAM APERTURE 8 cm; DC Bias 0 kV
TUNED by, coarse panels fine water pressure
RF 23.055 to MHz, stable ± $1/10^8$
Orb F 4.61 to MHz
HARMONICS, RF/Orb F, used 5
DEE–Gnd, max 85 kV, min gap 2.5 cm
STABILITY, (pk-pk noise)/(pk RF volt) $4/10^4$
ENERGY GAIN, max 340 kV/turn
RF PHASE, stable to ± deg
RF POWER input, max. 1100 kW
FREQUENCY MODULATION, rate /s
modulator, type
beam pulse, width

VACUUM SYSTEM

OPERATING PRESSURE 4 x 10^{-8} (Torr) or mbar
PUMPS. No, Type, Size 2 He cooled 20K cryopanels 1.2 m^2
4-16" cryopumps 1-18" cryopump
1-16" turbo, 1-10" turbo

ION SOURCES

Ehlers PIG H^-, CUSP H^-, Lamb shift polarized H^-

* - includes 4 funding universities
* - includes experimental facilities

INJECTION SYSTEM

40 m long: electrostatic dipoles, quadrupoles and spiral inflector

EXTRACTION SYSTEM

Electron stripping in 25μ pyrolytic graphite foil.

FACILITIES FOR RESEARCH

SHIELDED AREA, fixed 2350 m^2; movable m^2
TARGET STATIONS 17 in 12 rooms
STATIONS served at same time, max 10
MAG SPECTROGRAPH, type MRS. R=2.5m., QQD. R= 0.6m.
COMPUTER model VAX 8600., 11/780., 11/750., 11/730
OTHER FACILITIES Polarized fast neutron beam.
Thermal neutron source.
Biomedical Π^- irradiation

CHARACTERISTIC BEAMS

PARTICLE	ENERGY (MeV) Goal	Achieved	CURRENT (pμA) Internal	External
P	65–100	68–110		10
P	180–520	180–520	170	170
Polarized p		180–520	0.6	0.6
SECONDARY			(part/s)	
Π^+	20–350	20–300		10^7–10^8
μ^+	4–90	4–90		10^6–10^7

BEAM PROPERTIES

MEASURED		CONDITIONS			
PULSE WIDTH	25 RF deg	150	pμA of 500 MeV	H^-	ions
PHASE EXC. max	RF deg		pμA of	MeV	ions
EXTRACT eff	99.95%	140	pμA of 500 MeV	H^-	ions
RESOL ΔE/E	0.3 %	140	pμA of 500 MeV	H^-	ions
EMITTANCE	0.1%	3	pμA of 500 MeV	H^-	ions
(π mm-mrad)	3 axial 3 rad	140	pμA of 500 MeV	H^-	

OPERATING PROGRAMS, time distribution

BASIC NUCLEAR PHYSICS YES SOLID STATES PHYSICS YES
BIOMEDICAL APPLICAT. YES ISOTOPE PRODUCTIONS YES
Nucl. physics, condensed matter physics, applied research & cancer therapy operate simultaneously during high current operation.

REFERENCES/NOTES

1)
2)

PLAN VIEW OF FACILITY, COMMENTS, ETC.